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FORMULAS FOR SUGAR-SAVING SIRUPS

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QUANTITY OF SWEETENING INGREDIENT IN BOTTLED SOFT DRINKS

The quantity of sweetening ingredient to be used in bottled soft drinks depends upon the personal preference of the consumer, which is influenced by the acidity of the beverage. The acid beverages, such as ginger ale, cherry, raspberry, strawberry, pineapple, lemon, orangeade, grape, and other sodas, require more sweetening than do the non-acid beverages, such as root beer, sarsaparilla, birch beer, cream, chocolate, etc. Some consumers, especially children, prefer a sweeter product than do others. Consequently, from the standpoint of sweetness, soft drinks may be divided into "sweet" products and "dry" products, and since a "sweet" acid drink requires more sweetening than does a "sweet" non-acid drink, soft drinks may be further subdivided as indicated in Table 1, which shows the average quantity of sugar heretofore used in beverages.

Table 1.—*Normal quantity of sugar in soft drinks (based on analyses made in the Bureau of Chemistry)*

	Ounces per half-pint bottle
Non-acid group (sarsaparilla, root beer, etc.):	
In "sweet" products	3/4
In "dry" products	1/2
Acid group (lemon, grape, phosphates, etc.):	
In "sweet" products	1 to 1 1/3
In "dry" products	3/4

PRINCIPAL SWEETENING SUBSTITUTES

The principal sweetening ingredients proposed for replacing a part of the sugar in bottled soft drinks are corn sirup (ordinary glucose), corn sugar, maltose sirup, honey, and high grade refiners' sirup. After testing these products in various combinations with many different flavors, the Water Laboratory has found that:

(1) None of these products can be used to replace all of the sugar.

(2) Each of these proposed sweetening ingredients possesses a characteristic flavor which may affect the palatability of the beverage unless it is used judiciously in the proper combination with ordinary sugar.

(3) **The keeping quality of these products when made up into sirups is not so high as that of ordinary sugar sirup, but if the new sirups are filtered, boiled, and used immediately, the keeping quality of the finished beverage is satisfactory, as observed over a period of six weeks.**

(4) The relative sweetness of the products mentioned (except refiners' sirup) is as follows: Ordinary sugar, 100; honey (44°B), 75; corn sugar, 45; maltose sirup (42°B), 30; corn sirup (45°B), 20.

(5) These products can be used to replace one-fourth to one-half the amount of sugar ordinarily used, thereby effecting a saving of aproximately 50,000 tons of sugar a year.

FORMULAS

As a result of the experimental work conducted in the Bureau of Chemistry, the quantities of sugar, corn sirup, and refiners' sirup given in Formulas I to VI are suggested for the different types of soft drinks.

FORMULA I. SUGAR AND CORN SIRUP (COMMERCIAL GLUCOSE)

To be used for a **sweet** root beer, sarsaparilla, birch beer, cream, chocolate, or for a **dry** lemon, orangeade, and the following beverages made with **imitation** flavors: Cherry, raspberry, strawberry, pineapple, or grape.

Dissolve 100 pounds of granulated sugar and 200 pounds of corn sirup (45°B) in 27 gallons of pure water. The solution obtained will measure about 50 gallons. Filter, boil, and use immediately. Add 1 1/2 fluid ounces of this sirup to each half-pint bottle. Each 1 1/2 fluid ounces of this sirup will contain 3/8 ounce sugar and 3/4 ounce corn sirup (45°B).

FORMULA II. SUGAR AND CORN SIRUP (COMMERCIAL GLUCOSE)

To be used for a **dry** root beer, sarsaparilla, birch beer, cream, chocolate, or ginger ale.

Same formula as Formula I. Add 1 fluid ounce sirup to each half-pint bottle. Each ounce of the sirup made according to Formula I will contain 1/4 ounce sugar and 1/2 ounce corn sirup (45°B).

FOMULA III. SUGAR AND CORN SIRUP (COMMERCIAL GLUCOSE)

To be used for a **sweet** ginger ale, lemon, orangeade, or the following beverages made with **imitation** flavors: Cherry, raspberry, strawberry, pineapple, or grape, or for **dry true** fruit, blackberry, wild cherry, pineapple, strawberry, raspberry, or grape.

Dissolve 114 2/7 pounds of granulated sugar and 171 3/7 pounds of corn sirup (45°B) in 28.6 gallons of pure water. The solution obtained will measure about 50 gallons. Filter, boil, and use immediately. Add 1 3/4 fluid ounces sirup to each half-pint bottle. Each 1 3/4 fluid ounces of this sirup will contain 1/2 ounce sugar and 3/4 ounce corn sirup (45°B).

If it is desired to use a less concentrated sirup than the one given and to increase the quantity per half-pint bottle, the following formula may be employed.

Dissolve 100 pounds of granulated sugar and 150 pounds of corn sirup (45°B) in 31.3 gallons of pure water. The solution obtained will measure about 50 gallons. Filter, boil, and use immediately. Add 2 fluid ounces of this sirup to each half-pint bottle. Each 2 fluid ounces of this sirup will contain 1/2 ounce sugar and 3/4 ounce corn sirup (45°B).

FORMULA IV. SUGAR AND CORN SIRUP (COMMERCIAL GLUCOSE)

To be used for a **sweet true** fruit, **blackberry**, wild cherry, pineapple, strawberry, raspberry, or grape.

Dissolve 125 pounds of granulated sugar and 200 pounds of corn sirup (45°B) in 25.6 gallons of pure water. The solution obtained will measure about 50 gallons. Add 2 fluid ounces of this sirup to each half-pint bottle. Each 2 fluid ounces of this sirup will contain 5/8 ounce sugar and 1 ounce corn sirup (45°B).

FORMULA V. SUGAR AND REFINERS' SIRUP

To be used for a **sweet** sarsaparilla or other heavy-flavored, non-acid beverages, for **sweet** beverages containing extract of cola, and for **low-grade sweet** ginger ale, or for a **low-grade dry** lemon or other **low-grade dry** beverages of the acid group.

Dissolve 200 pounds of ordinary sugar and 100 pounds of high-grade refiners' sirup (40° to 44°B) in 27 1/2 gallons of pure water. The solution obtained will measure about 50 gallons. Filter, if not clear, and use immediately. Add 1 fluid ounce to each half-pint bottle. Each fluid ounce of this sirup will contain 1/2 ounce ordinary sugar and 1/4 ounce refiners' sirup.

NOTE.—The degrees expressed as °B are degrees Baumé.

FORMULA VI. SUGAR AND REFINERS' SIRUP

To be used for a **dry** sarsaparilla or other heavy-flavored, non-acid dry beverages, for beverages containing extract of cola, and **low-grade dry** ginger ale.

Add 1/2 fluid ounce of the sirup made according to Formula V to each half-pint bottle. Each 1/2 fluid ounce of this sirup will contain 1/4 ounce sugar and 1/8 ounce refiners' sirup.

EXCEPTIONS.

A cream soda made with 3/8 ounce sugar and 3/4 ounce corn sirup is less sweet than the other beverages of the same group, and a chocolate made with 1/4 ounce sugar and 1/2 ounce corn sirup is not quite sweet enough, even for a "dry" product. On the contrary, ginger ale made with 1/2 ounce sugar and 3/4 ounce corn sirup will be too sweet even for a "sweet" product, the combination 1/2 ounce sugar and 1/8 ounce or 1/4 ounce corn sirup being preferable. For a "dry" ginger ale, 1/4 ounce sugar and 1/2 ounce corn sirup gave satisfactory results. One-half ounce sugar and 3/4 ounce corn sirup will make a "dry" grape beverage, but more sugar will be required to make a "sweet" product.

Formula III can be used to make **dry true fruit,** blackberry, wild cherry, pineapple, strawberry, raspberry and grape beverages, but for **sweet** products of this nature, it will be necessary to increase the sweetening 30 per cent over that specified in Formula III.

With the exceptions noted, Formulas I to VI can be used as a general guide for preparing beverages.

MALTOSE SIRUP

If desired, the same quantity of maltose sirup (42°B) may be used in place of the corn sirup in Formulas I, II, III, and IV. In the case of maltose sirup, care should be taken to purchase only a high-grade product which is low in protein; otherwise, the keeping quality of the finished beverage will not be satisfactory.

CORN SUGAR

If it is desired to use corn sugar or honey in place of corn sirup, it will be necessary to use only about one-half as much, since these products generally are sweeter than corn sirup. The corn sugar used in these experiments was slightly off flavor. It is suggested that corn sugar be used only in beverages with heavy flavors, such as sarsaparilla and root beer, in which the slight, not altogether unpleasant bitterness is masked. It is suggested also that when corn sirup, corn sugar, etc., are used, the normal quantity of acid be reduced to two-thirds of the usual amount, and that the normal quantity of flavor be increased by one-half.

HONEY

Honey, when used in soft drinks, must be clarified; otherwise, with some beverages the coloring matter will be precipitated as a sediment, making the product unmarketable. The commercial liquid honey is made into a sirup, about 1 ounce of kaolin (china clay) is added per gallon, the solution well mixed and filtered through paper. It is necessary to return to the filter the first runnings which are not clear. The filtration proceeds rather slowly, and it is probable that a filter press could be used to hasten the process when conducted on a commercial scale.

REFINERS' SIRUP

Refiners' sirups which are being offered to the bottling trade vary greatly in quality and in price. The cost per gallon is not always a criterion of the quality. The strong molasses flavor and saline taste of even the best grades of refiners' sirup appear to limit its use largely to the non-acid and the cola beverages. It is believed, however, that bottlers will find it profitable to test thoroughly Formulas V and VI, which suggest the use of small percentages of refiners' sirups.

COLA BEVERAGES

Beverages containing extract of cola, etc., can be manufactured with good results, using any of the substitutes mentioned except honey. The quantities and proportions are practically the same as those used for "sweet" and "dry" sarsaparilla.

LIMITING PRODUCTION

Bottlers are urged, in the interests of sugar conservation, to limit the production of beverages such as grape, phosphates, and other acid drinks which require a large amount of sweetening to render them palatable. By curtailing the output of this type of beverage and by making use of the formulas here given, it is believed that the normal production of bottled soft drinks need not be greatly reduced and yet the supply of sugar will be conserved.

SACCHARIN

Saccharin, which some bottlers have proposed to use during the period of the war, has no food value, and is considered to be deleterious to health. Its use is prohibited by the laws or regulations of 14 States, and is believed by the Department of Agriculture to be within the inhibition of the Federal Food and Drugs Act (Food Inspection Decisions 135, 142); consequently, it is not classed with such products as corn sirup and maltose sirup.

LABELING SOFT DRINKS

The Federal Food and Drugs Act places no restriction on the use in soft drinks of corn sirup, maltose sirup, honey, corn sugar, and refiners' sirup. Their presence should be declared, however, on the label.

FOUNTAIN SIRUPS

The application of these formulas to the preparation of fountain sirups has not been experimentally determined, but it is believed that they can be satisfactorily employed provided slightly more of the sirup is used than is ordinarily employed in bottled beverages and care is exercised to observe strictly the suggestions regarding the keeping quality of the sirups.

REPORT OF RESULTS

The Bureau will appreciate it if bottlers using these formulas will report the results obtained, especially any difficulties experienced in their application.

SIRUP TABLES

In the manufacture of simple sirups, it is convenient to know the final volume, degrees Baumé, percentage sugar, etc., of the sirup obtained when a given weight of sugar or other sweetening ingredient is added to a given volume of water. Such data are not always available to the bottler, nor is it a simple matter to deduce them from the data which the average bottler can conveniently obtain. For this reason it was thought worth while to make the calculations contained in Table 2.

TABLE 2.—*Sirup table for the bottler*

Pounds sugar to each gallon water	Gallons sirup obtained	Ounces sugar to each fluid ounce of sirup	Percentage sugar in sirup by weight	Specific gravity (17.5° C/17.5° C)	Degrees Baumé (new)
4	1.296	0.386	32.43	1.1414	18.2
5	1.371	.456	37.50	1.1667	21.0
6	1.446	.519	41.86	1.1891	23.4
7	1.521	.575	45.65	1.2091	25.4
8	1.596	.627	48.98	1.2272	27.2
9	1.672	.673	51.92	1.2434	28.7
10	1.747	.716	54.54	1.2582	30.1
11	1.823	.754	56.90	1.2718	31.4
12	1.899	.790	59.01	1.2841	32.5
13	1.974	.823	60.94	1.2954	33.45
14	2.051	.853	62.68	1.3058	34.4
15	2.126	.882	64.28	1.3155	35.2

CAUTION

In many instances, as little as 1/8 ounce additional sugar to the half-pint bottle will raise the grade of a soft drink from an unmarketable product to a medium or high-grade product. Now, in a 10-pound sirup (i. e., 10 pounds sugar to each gallon of water taken), 1/8 ounce sugar is contained in 0.17 fluid ounces. If a machine is presumed to deliver 1 fluid ounce of sirup, but actually delivers only 3/4 fluid ounce, this would, therefore, in many cases affect the marketability of the product. Consequently, while it is always advisable to so adjust the machine to measure accurately the quantity of sirup delivered, it is particularly necessary if sugar substitute sirups are used. Serious errors may occur in making up the sirups, due to inaccurate measurement of the sweetening ingredients and of the water used. Especial care should be taken to make up the sirups of known strength, and in doing this, good use can be made of Table 2, in which the volume relations have been worked out accurately. The water should be measured at a temperature approximately 17.5°C. (63.5°F.), although a difference of 10°F. will not seriously affect the result. More serious errors are likely to result from the process of filtering and heating.